UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 710

Contribution from the Bureau of Animal Industry
JOHN R. MOHLER, Chief

Washington, D. C. PROFESSIONAL PAPER September 13, 1918

STAGGER GRASS (CHROSPERMA MUSCÆTOXICUM) AS A POISONOUS PLANT.

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CONTENTS.

DESCRIPTION AND CHARACTERISTICS.

Chrosperma muscætoxicum, commonly known as "stagger grass," "fly poison," "crow poison," or "fall poison," shown in figures 1 and 2, belongs to the lily family. It grows from a coated bulb, and reaches a height of from 1½ to 4 feet. The leaves are narrow and grasslike, those of the stem being few and short. The stem is much longer than the leaves and bears a dense raceme of flowers, which turn greenish with age. The fruit is red. The plant is found in sandy woods from Long Island to Florida and west as far as Arkansas. It is said to grow at an altitude of 4,000 feet in Virginia.

The plant was first brought to the attention of this department by Mr. F. L. Huggins, of Wilmington, N. C., in March, 1911. He sent specimens of the plant and reported that the people of that neighborhood knew it as "stagger grass," and said that it was fatal to sheep in 24 hours. He said also that many cattle had been sick and that some had died from its effects. The matter was deemed of sufficient importance to make an investigation of the locality where the losses had occurred. The locality is a typical plains region of eastern

North Carolina, with very sandy soil. The country is nearly flat and has numerous swamps, at a slightly lower level, which are known as bays. The soil of the swamps, of course, is more largely composed of decayed vegetable material than is true of the more elevated land. Locally such soil is known as sand-rock soil, by which apparently is meant a more or less ferruginous sand, which is somewhat compact. The Chrosperma in this neighborhood seemed to be mostly confined to

FIG. 1.—*Chrosperma muscætoxicum;* young plants in bud.

the sand-rock soil and was found most abundantly on the slopes of the bays. It did not appear to grow upon either the more elevated land or the wet land, but in the region intermediate between the two. It was found in patches, sometimes several square rods being covered very thickly with it. At the time of the first visit, April 2, 1911, it looked very much like grass, was from 4 to 6 inches in height, and was the most conspicuous green vegetation upon the surface. The bulbs

are only 2 or 3 inches below the surface, but it does not seem probable that any animal in grazing would pull them up. Inquiry of Mr. Huggins and other people developed a good many interesting facts in

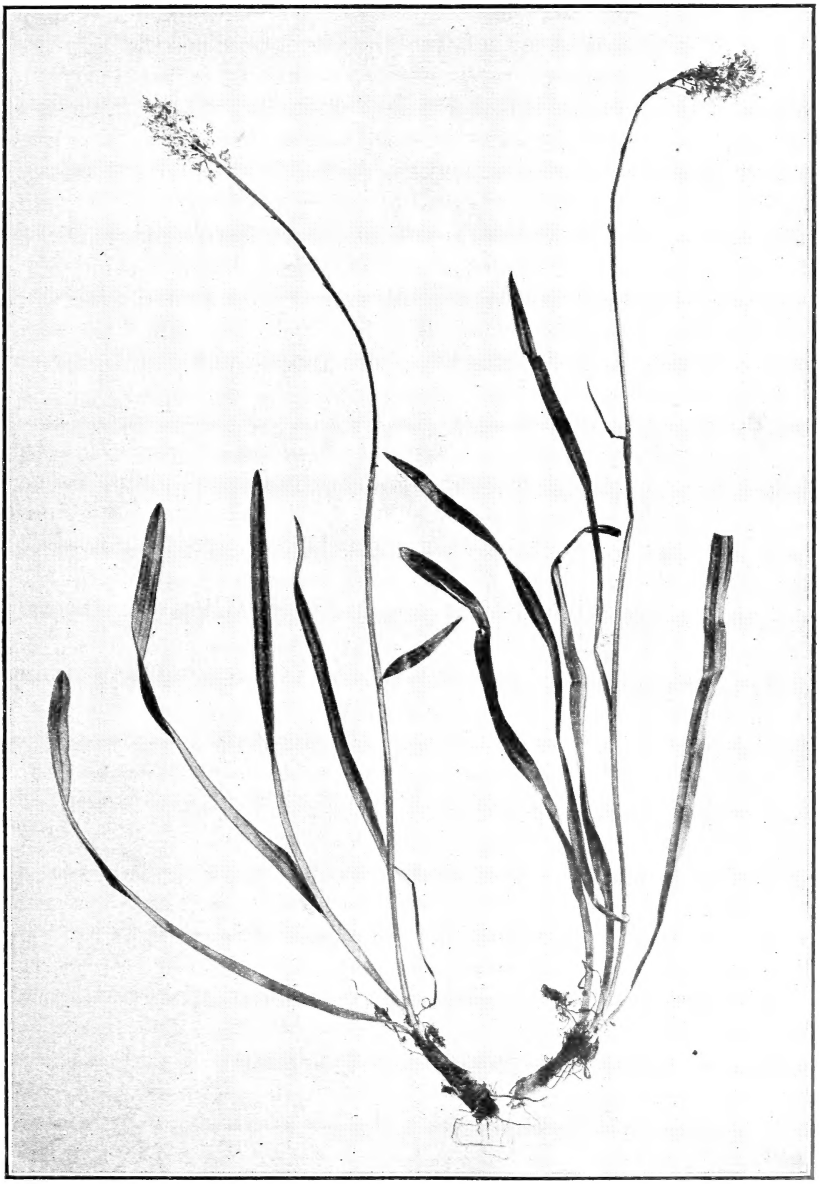

FIG. 2.—*Chrosperma muscætoxicum;* mature plant in blossom.

regard to the losses of animals in the locality. It appeared that the losses were almost entirely confined to cattle, although it was said that sheep were also affected by it, and that mules and horses might be

poisoned. As a matter of fact, cattle run wild throughout the region, but horses are never turned loose and perhaps would not have an opportunity for getting hold of the plant. Pigs also run about wild, but are never known to be poisoned.

All the cases of poisoning occur early in the spring, doubtless owing to the fact that at that time the Chrosperma is the only green plant and consequently is attractive to a grazing animal. Just how extensive the losses were it was impossible to find out, but it appeared that some occurred every year and that the plant was recognized by the people of the neighborhood as particularly destructive to cattle. The subject was deemed of sufficient importance to demand a careful investigation, inasmuch as the plant grows somewhat widely and may be the cause of losses not only in North Carolina but in other States. Queries in regard to the poisonous properties of Chrosperma have come from other localities, but the only definite reports of losses of live stock have been from North Carolina.

HISTORICAL SUMMARY.

The original description of the plant under the name *Melanthium muscætoxicum* was by Walter,[1] in the Flora Caroliniana, in 1788. The plant has received a large number of names, the discussion of which belongs to the systematic botanist. By many botanists it is placed in the genus *Amianthium*. The name used in this paper is the one recognized by Britton and Brown in "Illustrated Flora of Northeastern North America."

Apparently very little has been published concerning the poisonous properties of this plant.

Elliott, 1817, says:

> This plant is a narcotic poison, and is employed in some families for destroying the housefly. The bulbs are triturated and mixed with molasses or honey and the preparation is spread upon plates and placed in parts of the house most effected. The flies are soon attracted, and the poison takes effect while they are sipping it. They are perceived to stand unsteadily, totter, and fall supine. The flies, unless swept into a fire or otherwise destroyed, revive in the course of 24 hours.

This appears to be the earliest mention of the poisonous properties of the plant, although it is to be presumed from the specific name given that Walter knew of this use of the plant.

Mohr, 1890, states that the root is poisonous.

Chesnut, 1898, says that it "is sometimes eaten by cattle with fatal results. The hulls, when mashed up with molasses, are used to stupefy flies."

In the National Standard Dispensatory, second edition, 1909, page 914, is the statement that it "is the fly, crow, or fall poison of the United States Atlantic coast region. It is used as an insecticide, and is poisonous to birds."

[1] A list of literature cited appears at the end of this paper.

Alsberg, 1912, writing of "The Toxic Action of *Amiamthium muscætoxicum*," says:

> This liliaceous plant contains a solid alkaloid which has not been obtained in crystalline form. The alkaloid is of extreme toxicity, producing death from respiratory paralysis. The effect on the circulation is less prominent than that on the respiratory center. Striped muscle is affected in such a way that fatigue, both by direct and indirect stimulation, is very much more rapid than normally. Relaxation is somewhat delayed, but no distinct veratrine effect was obtained, though the alkaloid in some respects resembles veratrine chemically.

Alsberg, 1914, says: "From a member of a closely related genus *Amianthium muscætoxicum*, a similar active principle was obtained in an impure state. Apparently many of the species of this group of lilies contain 'veratrine' alkaloids or alkaloids related to it."

While the plant is mentioned by other authors as "fly poison" or "crow poison," the few statements given above seem to comprise all that has been written of its poisonous properties.

EXPERIMENTAL FEEDING OF THE PLANT.

A number of experiments of feeding the plant to both cattle and sheep were made, a summary of which is given in the following table. The plant material used was obtained from Wilmington, N. C.

TABLE 1.—*Summary of feeding experiments with Chrosperma muscætoxicum.*

Animal.		Experimental feeding.				Severity of illness.	Remedy.	Result.
Designation.	Weight.	Date.	Weight of plant fed.	Pounds fed per stated weight of animal.	Part of plant fed.			
	Lbs.	1911.	*Lbs.*	*Per 1,000 lbs.*				
Cattle No. 122..	108	Apr. 13..	0.1540	1.43	Leaves.....	Not sick.....	.....	
Do.....	108	Apr. 14..	.0990	.91564	.....do.....	Sick for some hours	None.....	Recovery.
Do.....	108	Apr. 18..	.0880	.814	Roots.....	Not sick.....	.....	
Do.....	108	Apr. 19..	.0220	2024	.....do.....	Slightly sick	None.....	Do.
Do.....	108	May 4....	.0836	.77	Leaves.....	.....do.....	.....do.....	Do.
Do.....	108	May 5....	.1914	1.77	.....do.....	Slightly sick May 6.	Caffeine sodiobenzoate.	Do.
		1914.						
Cattle No. 663..	240	Mar. 23..	.545	2.261	.....do.....	Very sick....	None.....	Do.
Do.....	240	Apr. 3....	.220	.917	Bulbs; fed in grain.	Salivated....	.....do.....	
				Per 100 lbs.				
Sheep No. 228..	72	Mar. 24..	.044	.061	Leaves; fed in rye.	Symptoms..	.....do.....	Do.
Do.....	72	Mar. 25..	.066	.092	Leaves; forced feeding.	Very sick....	.....do.....	Do.
Do.....	72	Apr. 3, 4.	.331	.460	.....do.....	.....do.....	.....do.....	Do.
Sheep No. 277..	98.5	May 26..	.110	.112	Leaves, stems, and flowers; drench.	Not sck.....	.....do.....	
Sheep No. 280..	99	May 26..	.055	.056	.....do.....	.....do.....	.....do.....	
Sheep No. 261..	76	May 27..	.251	.330	Leaves; drench...	Death.....	.....do.....	
Sheep No. 283..	78.5 to 76.5	May 27..	.172	.219	.....do.....	Symptoms..	Raw oil and turpentine.	Do.

TYPICAL CASES.

CATTLE NO. 122.

The experimental work with calf No. 122 may be considered as giving typical results of the poisoning of cattle. The calf was somewhat undersized and poor, and weighed 108 pounds.

The feeding of the Chrosperma was commenced April 13, 1911. On this date 70 grams of the leaves of the plant were fed without any resulting symptoms. The plant material was received about April 11, and had been kept in cold storage. On April 14 the calf ate 45 grams of the leaves. This feeding was commenced at 10.25 a. m.,

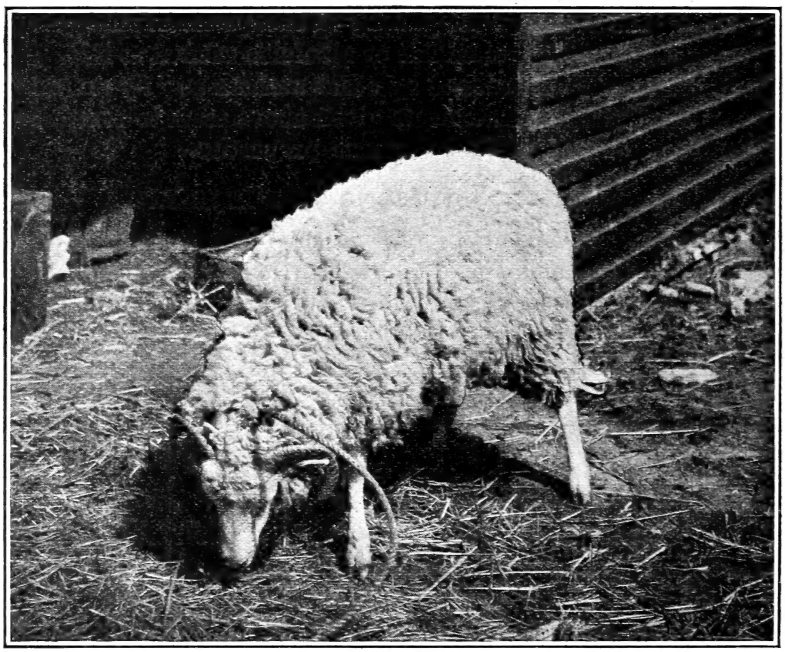

FIG. 3.—Sheep No. 228 at 1.14 p. m., March 25, 1914.

and at 11.40 the animal showed distinct signs of feeling ill. Her back was arched, she vomited, refusing to eat any more, and moaned. This condition continued until 12.06, and during this time the animal was quite sick. While lying down she threw her head sometimes from side to side and gave evidence of abdominal pain. After that there was less evidence of pain, but still much discomfort. The temperature was about normal. The animal appeared to be recovering and the observer left at 1.30 p. m. During the following night she was seen at intervals by the watchman, who reported that she vomited repeatedly. She staggered when walking, appearing to be especially weak in the hind parts. She did not recover her appetite until about noon, April 16. The effect of the poison apparently continued from April 14 to noon of April 16, or about 48 hours.

On April 18, at 11.30 a. m., experimental feeding was commenced again with the same animal. On that date she ate 40 grams of ground roots without any distinct symptoms of illness, and on April 19 she ate 10 grams. Between 12 and 2 p. m. on April 19 it was evident that she felt very uncomfortable. There was some constipation, although there was none on the preceding day. She was nauseated, but did not vomit, and would eat nothing. After 1 o'clock there was slight salivation.

On the succeeding day, April 20, she had entirely recovered, was eating grass, and the constipation had been relieved.

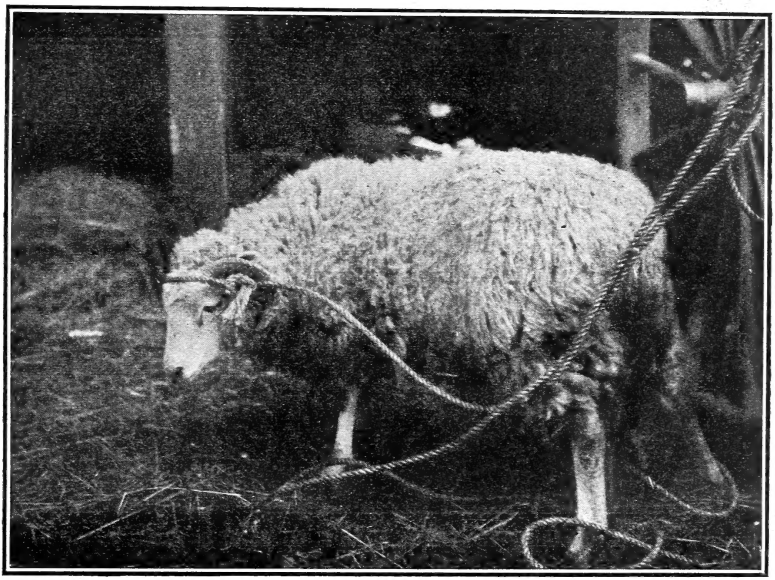

FIG. 4.—Sheep No. 228 at 4.30 p. m., April 4, 1914.

On May 4 feeding was commenced again, after 24 hours without feed. She ate 38 grams of leaves, the feeding commencing at 11.15 a. m. Between 3 and 4 p. m. there was distinct evidence of discomfort, and she ceased to eat, but there were no further symptoms of poisoning. The feeding was continued on May 5, when she ate 87 grams of the leaves. No symptoms appeared on that day, but on May 6, at 11 a. m., she was found to be breathing as if in discomfort and staggered when upon her feet. At 12 o'clock she groaned as if in pain, was constipated, and stopped eating entirely. There was some salivation. At 1.19 p. m. she was given 5 grains of caffeine sodiobenzoate. At 2 o'clock she appeared to be in good condition.

SHEEP NO. 228.

The experiments with sheep No. 228 may be considered as typical of the effects of the plant upon sheep.

This sheep, a healthy ewe, weighing 72 pounds, was deprived of food on March 21 and 22, 1914, and on March 23 an attempt was made to make her eat the Chrosperma, which had been sent from North Carolina and had been kept in cold storage. As she would not take it, food was withheld for 24 hours longer. March 24, at 11.35 a. m., 10 grams of Chrosperma tops in green rye were given. At 11.41 a. m. another 10 grams mixed with rye were given. All this material was eaten in the course of the afternoon. On the morning

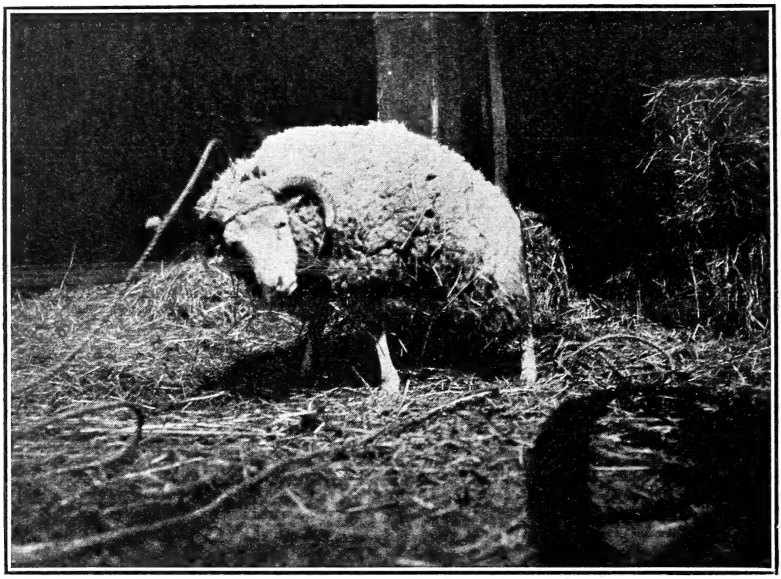

FIG. 5.—Sheep No. 228 at 10.25 a. m., April 5, 1914.

of March 25 the watchman reported that the sheep had been salivated during the night. She refused that morning to eat rye, but otherwise seemed to be all right.

At 10.25 a. m., March 25, 10 grams of the plant cut up fine and mixed with corn, oats, and wheat was offered, but very little was eaten, so that the material was fed by putting it directly into the sheep's mouth. Another 10 grams was given at 11.05 a. m., and a third 10 grams at 11.45 a. m. At 11.43 the ewe held her head low and shook it from side to side as if nauseated. At 11.45 there was distinct salivation, and at 12.05 vomiting. This condition of illness, representing nausea, extreme discomfort, and weakness, continued until between 2 and 2.30 p. m., at which time the sheep seemed to be very much better. Figure 3 shows the condition at 1.15 p. m.

March 26, 9.40 a. m., the sheep was lying down, but when made to get up staggered, licked her lips, and ground her teeth. She was weak and very much depressed but was able to stand. When walking the sheep was so weak that a slight pull upon a rope around the

horns caused her to fall over, and she would then not get up voluntarily, but if helped up would remain standing. The sheep was reported as having been very sick during the night. This condition of weakness continued during the day. On March 27 she was much better but still weak, and was eating nothing, but on March 28 she had practically recovered, and was in a normal condition.

April 3 the sheep, which had entirely recovered from the previous feeding, after having been deprived of food for 24 hours, was fed

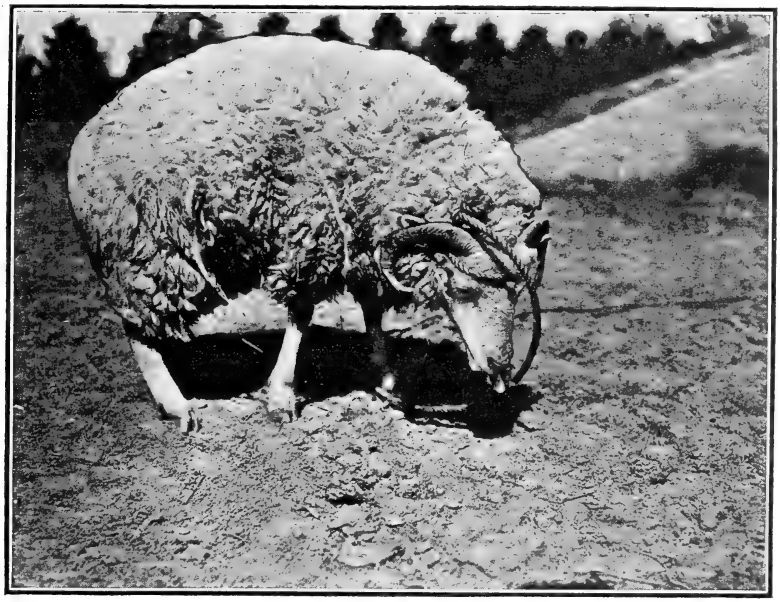

FIG. 6.—Sheep No. 228 at 9.35 a. m., April 6, 1914.

between 10.50 and 11.10 a. m. 100 grams of leaves of the Chrosperma. This material was from the same collection as that used in the earlier experiments; it had been kept in cold storage and was in good condition. In this case the plant was fed by placing it, after it was cut up, directly into the back of the sheep's mouth, thus forcing the animal to swallow it, as she would not do so voluntarily. At 11.10 a. m. she was distinctly nauseated, and this condition continued marked for perhaps an hour, when the sheep seemed to be better, but was sleepy and listless. No marked symptoms were noticed until about 3 p. m., when vomiting commenced.

April 4, 9.30 a. m., the animal, lying down and apparently resting easily, was made to get up and walk about, when she showed that she was very weak, for she staggered when walking, and groaned. Figure 4 shows quite clearly an attitude indicating great weakness. As it was deemed best to carry the experiment farther, 50 grams of leaves, fed in the same way as before, were given between 10.50 and

10.55 a. m. During the remainder of the day there were no more pronounced symptoms, although the animal continued weak and evidently was in pain, as indicated by occasional groaning.

April 5, 10.25 a. m., the sheep was lying quietly in the pen, but when taken out proved to be very weak. She frothed at the mouth, grated the teeth, and while breathing groaned as though in pain. Figure 5 shows an attitude assumed at that time. There was no marked change in the condition of the animal during the day.

April 6, 9.35 a. m., the sheep appeared better and when taken out walked about but soon became weak and fell down with labored respiration, having great difficulty in getting her breath. Figure 6 shows the condition of the animal at the time. She was frothing at

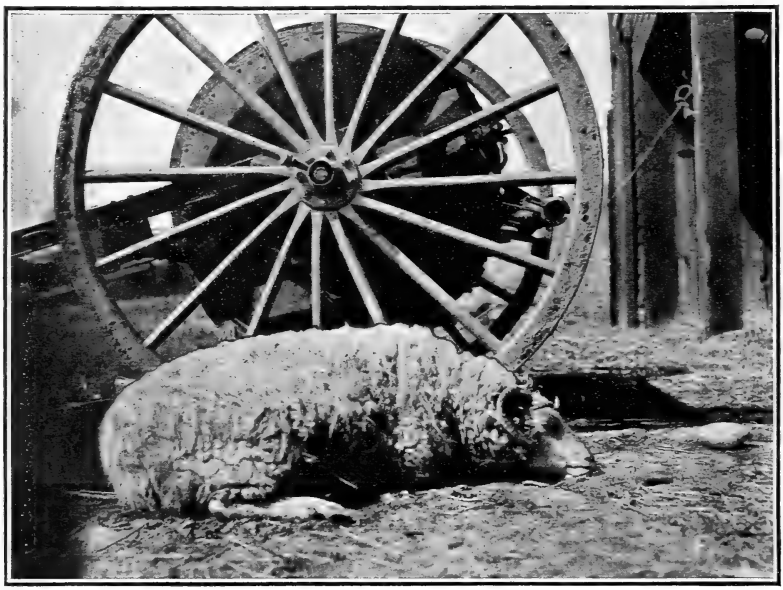

FIG. 7.—Sheep No. 228 at 10.35 a. m., April 6, 1914.

the mouth and panting with very rapid respiration—about 200 a minute. Figure 7 shows the sheep an hour later, 10.35 a. m. The condition of the animal did not materially change during the day.

On April 7 when taken out of the pen the sheep staggered in attempting to walk, the legs being very weak. She breathed with gasps, was frothing at the mouth, pulse was 140, temperature 102. The illness was much more pronounced than on the preceding day.

On April 8 the sheep was very much better but still weak. Figure 8 shows very clearly the weak condition as it existed at 10.09 a. m. The animal was not frothing at the mouth, however, and showed a desire to eat. It was evident that she was recovering and that the trouble was mainly weakness. In order to get a complete record of

the case the sheep was killed and an autopsy made which showed nothing abnormal in the internal structures. Material of the liver, lung, kidney, and spleen was turned over to Dr. A. R. Ward, of the Pathological Division, Bureau of Animal Industry, who made the following report:

AUTOPSY ON SHEEP NO. 228.

Liver.—The organ is normal to all intents and purposes. The hepatic cells took the staining well, and a good contact between the cytoplasm and karyoplasm is present in the well-marked lobules. There is no congestion, no inflammation, nor any cell proliferation of any kind. However, if we wish to be hypercritical, there appears a very slight, cloudy swelling with minute areas of serous fluid in the hepatic cells nearest to the capsule of Glisson.

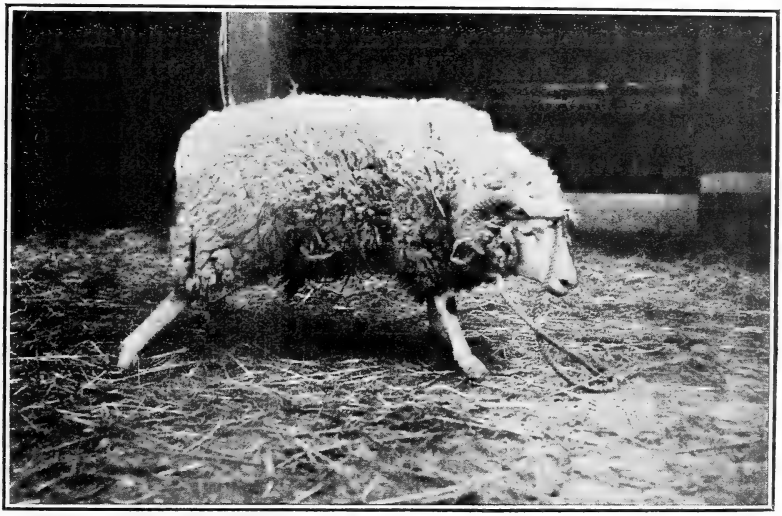

FIG. 8.—Sheep No. 228 at 10.09 a. m., April 8, 1914.

Lung.—Pleura thickened. Subendothelial capillaries prominent but empty. The air cells, infundibula, and pulmonary epithelium show no deviation from the normal. The smaller bronchial tubes are normal, but the larger ones show a slight peribronchial cell infiltration but no catarrh.

Kidney.—Capsule normal. Renal capillaries show no alteration except those constituting the glomeruli, which appear to be distended. There is a moderate number of red blood corpuscles which have passed into the capsule of Bowman. No parenchymatous and no interstitial changes are present.

Spleen.—Neither the splenic pulp nor the splenic corpuscles show any alteration. There is a small excess of hematogenous pigment, indicating that a number of red blood corpuscles have been disintegrated in the spleen.

GENERAL CONCLUSIONS.

TOXIC DOSE.

The only animals used for experimental purposes were cattle and sheep, and the number of experiments was too small to determine the dosage with any exactness. The fact that the symptoms sometimes

occur after a considerable delay also adds a doubtful factor to the determination of the dosage. The experiments with calf No. 122 in 1911 indicated that the toxic dose was not far from 1 gram, or 0.0022 pound, per pound of animal weight: or, put in another way, a 1,000-pound bovine would probably be poisoned by 2.2 pounds of the plant. The experiments with cattle in 1912 and 1914 served to confirm this general conclusion, and it seems probable that the toxic dose for a bovine weighing 1,000 pounds is not far from 2 pounds.

In the case of the sheep, symptoms were produced by 0.061 pound per 100 pounds of animal, and death was produced by 0.330 pound. Inasmuch as sheep No. 283 was sick and recovered from 0.219 pound, the lethal dose is somewhere between that figure and 0.330 pound. The large dosage received by sheep No. 228 on April 3 and 4 was distributed over two days with consequently less effect. In general, while too much reliance must not be placed on the results of a few experiments, it may be said that sheep may be poisoned by 0.06 pound, and fatal results may occur from a quantity between one-quarter and one-half of a pound. It will be noticed that, in terms of a ratio to body weight, the dosage for cattle and sheep is very nearly the same.

While the number of cases is small and there are a number of factors that throw doubt on the results, such as the varying conditions of the animals, the varying length of time in the feedings, etc., nevertheless the results may be considered as indicating approximately both the toxic and the lethal dose.

It appears to be probable from these experiments that Chrosperma is much more poisonous than the Zygadenus which causes such heavy losses of sheep in the West.

SYMPTOMS.

Salivation.—This is the first symptom noticed. The animal ceases eating and there is frothing at the mouth in a marked degree.

Nausea.—There are pronounced symptoms of nausea, which is followed in severe cases by profuse vomiting.

Pulse.—The pulse during most of the illness is nearly normal, although it may be somewhat rapid in the more acute stages of the intoxication.

Respiration.—The respiration is rather more rapid than normal and is frequently labored and irregular.

Temperature.—There is not much change in temperature, but it is liable to be slightly lower than normal.

Weakness.—The animal becomes very weak and staggers when it attempts to walk. When walking it moves in a stiff-legged manner.

Autopsy.—The autopsy findings indicate that in the organs there is little change which can be considered typical of the disease.

POISON CUMULATIVE.

The toxic effect of Chrosperma in the drenched cases appeared very quickly; in the fatal case death occurred in one hour. In the fed cases, however, even when the feeding was done by hand and consequently took but a short period of time, the symptoms appeared after several hours. When the feeding was done in the forenoon the most pronounced symptoms did not appear until the latter part of the afternoon or in the night. They persisted, too, for a long time. In the cattle they continued for two days, and one of the sheep was not completely recovered at the end of six days.

From this persistence of the toxic effect it seems that the poison is somewhat cumulative. In the cases in which feeding was continued on the second day it is pretty clear that its effect was added to that of the first day's feeding.

It seems probable that the long-continued illness resulting from eating the Chrosperma is due not so much to the severity of the toxic effect as to the fact that probably the active principle is extracted and absorbed somewhat slowly. It is to be presumed that in the drenched cases, inasmuch as the leaves were ground up and mixed with water, the poisonous principle is partly extracted at the time of the feeding. Moreover, the material of which a drench is composed goes in large part directly to the fourth stomach and consequently is quickly absorbed.

ANIMALS SUSCEPTIBLE.

The experimental work was with cattle and sheep, both of which were shown to be susceptible to the poisonous effect of the plant. As is stated earlier in the paper it is said in North Carolina that horses and mules, but not swine, are poisoned. The plant is shown to be so very poisonous that it seems probable that most animals are affected if they eat it.

One case of a child eating it and barely surviving has been reported to the writers. It seems rather strange that no more human cases have been known, for it seems certain that it is a very dangerous plant.

REMEDIAL MEASURES.

Not much can be done in the way of medicinal remedies. Doubtless a purgative would aid in eliminating the toxic substances. Experimental work on the related plant, Zygadenus, indicates that little can be expected from strictly antidotal treatment. Almost all that can be done is to keep the animals quiet and wait for the effects of the poison to pass off. Inasmuch as the effects of the toxic substance may continue for 2 or 3 days, or even longer, rapid recovery must not be expected.

SUMMARY.

Chrosperma muscætoxicum has been recognized as poisonous, but has not previously been reported as a stock-poisoning plant.

The plant has been known locally, in parts of North Carolina, as dangerous to cattle and sheep.

Experimental work has confirmed the opinion of its poisonous properties, and has shown that it is an extremely toxic plant.

Inasmuch as the plant occurs from Long Island to Florida and as far west as Arkansas, it seems probable that it may cause losses of stock in many places besides those reported.

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